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PATENT AND TECHNICAL TRANSLATION

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DECLARATION

The undersigned, Olaf Bexhoeft, hereby states that he is well acquainted with both the English and German languages and that the attached is a true translation to the best of his knowledge and ability of the German text of PCT/EP2004/050178 filed 02/20/2004, and published on 12/23/2004 as WO 2004/110761 A1, and of two amended claims.

The undersigned further declares that the above statement is true; and further, that this statement was made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.



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Specification

Printing Units Comprising Bearing Rings in a Rotary Press

The invention relates to printing units of a rotary printing press in accordance with the preambles of claims 1, 2 or 9.

When driving cylinders or groups of cylinders by means of separate drives, for example in satellite printing units, process-related unwinding differences between the cylinder pairs can occur. These are a function of the contact pressure, the number of active print locations, the thickness of the dressing, the type, and even the manufacturer of the dressing itself, whether the friction drive is embodied without bearing rings or with bearing rings, or of the bearing rings or of the radius ratios of the friction drive as a whole.

In part, this can lead to considerable and, under changing conditions different, output flows between the cylinders or cylinder groups. This is undesired, since they lead to asymmetries in the output design or, depending on the conditions and modes of operation, to different outputs, or even to overloading of the motors and regulating devices.

Even with cylinder groups, printing groups, printing units or printing towers which are operated together by means of gears, this leads to undesired moments, increased friction and wear.

Cylinders of a rotary printing press with bearing rings are known from DE 195 01 243 A1, wherein the bearing rings of

the satellite cylinder are rotatably seated for the purpose of reducing the output transfer.

In WO 00/41887 A1, a compensating friction gear in the form of bearing rings of a radius ratio not equal to one is overlaid on a friction gear of cylinders which are in frictional contact for process-related reasons. In this case the bearing ring of the counter-pressure cylinder is larger than the barrel of the latter and larger than the bearing ring of the cooperating transfer cylinder. In the priority document DE 199 27 555 A1 the relationships between the transfer and counter-pressure cylinders are shown in the reversed way in a drawing figure.

USP 3,196,788 discloses a printing group for offset printing on two sides, wherein the transfer cylinders and the associated forme cylinder have different radii in the area of their barrels. Three pairs each of bearing rings working together are arranged on three different levels. Each of the pairs has the same diameter.

In USP 2,036,835 A, the ratios of the diameters of the cylinders in respect to each other are shown in such a way that the transfer cylinder is smaller and the counter-pressure cylinder and forme cylinder larger than the diameters of the bearing rings, which is identical for all three cylinders.

The object of the invention is based on creating printing units of a rotary printing press.

In accordance with the invention, this object is attained by means of the characteristics of claims 1, 2 or 9.

The advantages to be gained by means of the invention lie in particular in that, because of the special conditions

in the area of the friction gear constituted by the cylinders, it is possible to achieve a considerably lower output displacement. Also, a higher print quality is possible by this because of so-called "true-rolling".

This applies in particular to printing groups which have a cylinder which does not conduct ink, in particular a satellite cylinder, and several transfer cylinders working together with the latter. In this case the staggering of the three cylinders in their layout in relation to each other is of particular advantage, since not only one cylinder, but several contribute to the potential output displacement. A substantial advantage results in connection with bearing ring rollers for a bearing ring which is reduced in size in comparison with the satellite cylinder.

In an advantageous embodiment the size of the bearing rings of the three cylinders can be staggered in pairs in respect to each other. If desired, the staggering of the three bearer rings in respect to each other can be provided in place of the staggering of the cylinders or, in an advantageous further development, in addition to the staggering of the cylinders.

Exemplary embodiments of the invention are represented in the drawings and will be described in greater detail in what follows.

Shown are in:

Fig. 1, a schematic representation of cooperating cylinders of a rotary printing press,

Fig. 2, a portion of a friction bearing of two cylinders in an enlarged view,

Fig. 3, a schematic representation of a nine cylinder printing unit with drive mechanisms in pairs,

Fig. 4, a schematic representation of a nine cylinder printing unit with individual drive mechanism,

Fig. 5, a schematic representation of a 10 cylinder satellite printing unit,

Fig. 6, a representation of a nip point.

A rotary printing press has a printing group 01 with three cylinders 02, 03, 04, which in a print-on position work together with each other. For example, the first cylinder 02 is embodied as a forme cylinder 02 and has on its outward oriented outer surface 06 an information of an image to be printed. The image to be printed can be provided in the form of a structure for letterpress printing, rotogravure printing or planographic printing directly on a shell face of the forme cylinder 02 itself, or on a printing forme 09 (printing plate, sleeve, printing block), which is releasably arranged on a base body 08 of a radius r_{08} of the form cylinder 02 and of a thickness d_{09} of, for example, $d_{09} = 0.25$ to 0.33 mm, in particular 0.27 to 0.30 mm. In each one of the two cases the outer surface 06 with the printed image defines an effective radius r_{02} of the forme cylinder 02. The forme cylinder 02 with the printing forme 09 and, if required, one or several not represented intermediate layers, are substantially incompressible, i.e. designed with a fixed radius r_{02} .

In the area of its shell face, the second cylinder 03 embodied as a transfer cylinder 03 has at least one layer 11 with compressible and/or elastic properties on a substantially incompressible, inelastic cylinder core 12 of a

radius r_{12} . The layer 11, for example in the form of a dressing 11, in particular a rubber blanket 11 (ultimately as a sleeve, etc.), is releasably arranged on the cylinder core 12. The radius r_{12} of the cylinder core 12 can be defined either by the shell face of the base body 13 of a radius r_{13} or, in case of the presence of one or several intermediate layers 14, for example an underlayer 14, by the surface of the outermost intermediate layer 14. The intermediate layer(s) is (are) used for adaptation to various thicknesses d_{11} of rubber blankets 11, and/or the thickness of materials to be imprinted. If the layer 11 is embodied as a layer 11 connected with an incompressible support layer, for example as the layer of a metal blanket, within the meaning of incompressibility the radius r_{12} is to be understood to include the thickness of the incompressible support layer, for example the metal plate.

Because of the elastic and/or incompressible layer 11, the transfer cylinder 03 has an outer radius r_{03u} in the unloaded state, i.e. in the print-off position, and an outer, or effective radius r_{03b} in the loaded state, i.e. in the print-on position of the cylinders 02, 03, 04, which are placed in pairs against each other. In this case, the distance of the axis of rotation R_{02} , R_{03} , R_{04} of the respective cylinder 02, 03, 04 from the nip point in the connecting plane of the axes of rotation R_{02} , R_{03} , R_{04} is to be generally understood as the "radius in the loaded state", or effective radius. In this connection a distinction should possibly be made between the radius r_{03b1} in the loaded state in the area of the nip point 16 with the forme cylinder 02 (Fig. 2), and the radius r_{03b2} in the loaded state in the

area of the nip point 17 with the further cylinder 04. In Fig. 2, the reference numerals of the nip point 17 between the transfer cylinder 03 and the third cylinder 04 have been placed in parentheses. This nip point 17 simultaneously constitutes a print location 17 for a web 18 (in dashed lines) to be imprinted, for example a paper web 18.

The cylinder 04 which, acting as counter-pressure cylinder 04, forms a print location together with the transfer cylinder 03, can be either embodied as a transfer cylinder of a second cylinder pair, or as a cylinder 04 which does not conduct ink, against which one or several transfer cylinders 03 can be placed by means of a non-represented web.

In the embodiment represented, the counter-pressure cylinder 04 is embodied as a cylinder 04 which does not conduct ink and is embodied to be substantially incompressible, i.e. with a fixed outer radius r_{04} . This radius r_{04} can possibly include non-represented incompressible layers applied to a basic cylinder body and in that case constitutes an effective radius r_{04} (for example also toward the nip point) in the print-on position.

In an advantageous embodiment, the forme and transfer cylinders 02, 03 which, in the print-on position form a friction drive, are dimensioned and/or placed against each other in such a way that in the loaded state the forme cylinder 02 has a greater radius r_{02} , for example at least greater by 0.2 per thousand, than the radius r_{03b1} of the transfer cylinder 03 at the nip point 16. A ratio of the radius r_{02} of the forme cylinder 02 in respect to the radius r_{03b1} of the transfer cylinder 03 in the loaded state, i.e. in the print-on position lies, for example, at 1.0015 up to

1.0030, preferably at 1.0020 up to 1.0025. In this case the ratio of the radius r_{02} of the forme cylinder 02 to the radius r_{03u} of the transfer cylinder in the unloaded state can lie between 1.0000 and 1.0015, in particular 1.0010 and 1.0015, for example.

The thickness d_{11} of the relieved layer 11 in the unloaded case already used during the printing process (i.e. not unused) for example lies between 1.5 and 2.5 mm, in particular between 1.8 and 2.1 mm. The radius r_{12} of the cylinder core 12 should be embodied corresponding to the above mentioned ratios. In this case it is possibly necessary to take an intermediate layer 14 of a thickness of, for example 0.14 mm to 0.22 mm, into consideration in the course of dimensioning the radius r_{13} of the base body 13.

In the case of a printing group 01 with cylinders 02, 03 of double circumference, i.e. of a circumference which substantially corresponds to two vertical printed pages arranged one behind the other, in particular newspaper pages, the radius r_{02} of the forme cylinder 02 lies, for example, between 140 and up to 190 mm, in particular between 155 and 180 mm. Now, in the print-on position (loaded state), the transfer cylinder 03 has a radius r_{03b1} which is smaller by 0.14 up to 0.20 mm, in particular by 0.16 to 0.18 mm, than the radius r_{02} of the forme cylinder 02. The latter is set by the fixed radius r_{02} of the incompressible forme cylinder 02 and the relative position of axes of rotation R_{02} , R_{03} of the cylinders 02, 03 in respect to each other in the print-on position wherein, however, a maximum radius r_{12} of the incompressible cylinder core 12, as well as a minimum thickness d_{11} of the layer 11, must simultaneously be taken

into consideration. In an advantageous embodiment, the thickness d_{11} has been selected in such a way that, in the unloaded state, there is an excess dimension T_{03a} of approximately 0.13 up to 0.21 mm, in particular approximately 0.16 up to 0.18 mm in comparison with the loaded state, i.e. in case of contact the layer 11 is pushed in by the stated amount by the forme cylinder 02 (corresponds to the indentation depth). If a previously unused rubber blanket 11 is employed, the transfer cylinder 03 initially has a radius r_{03u} in the unloaded state which is greater by a penetration thickness F (represented in dashed lines in Fig. 1), for example 0.02 to 0.05 mm, as well as a correspondingly increased excess dimension T_{03a} .

A contact position is preset, for example by means of one or several stops, in such a way that in their contact position the two cylinders 02, 03 have the above mentioned radius ratio in the area of the nip point 16 (connecting plane of the axes of rotation R_{02} , R_{03}), and wherein in an advantageous further development a ratio between the excess dimension T_{03a} and the thickness d_{11} of the layer 11 lies between 5% and 15% in the unloaded (collapsed) state.

In an advantageous embodiment the transfer and counter-pressure cylinders 03, 04, which constitute a friction gear in the print-on position, are dimensioned or placed against each other in such a way that the forme cylinder 02 also has a greater radius r_{02} , for example at least greater by 0.1 per thousand, than the radius r_{04} of the counter pressure cylinder 04. A ratio of the radius r_{02} of the forme cylinder 02 to the radius r_{04} of the counter-pressure cylinder 04 preferably lies between 1.0001 and 1.0002.

In the case of the above mentioned printing group 01 with cylinders 02, 03 of double circumference, the counter-pressure cylinder 04 has a radius r_{04} which is smaller by 0.02 to 0.10 mm, in particular by 0.04 to 0.06 mm, than the radius r_{02} of the forme cylinder 02.

A distance for the print-on position between the axes of rotation R_{03} , R_{04} of the transfer cylinder 03 and the incompressible counter-pressure cylinder 04 is selected in such a way that in the loaded state a ratio between the radius r_{04} of the counter-pressure cylinder and the radius r_{03b2} of the transfer cylinder 03 lies between 1.001 and 1.003. This is set by the fixed radius r_{04} of the incompressible counter-pressure cylinder 04 and the relative position of the axes of rotation R_{04} , R_{03} of the cylinders 04, 03 in respect to each other in the print-on position, wherein, however, a maximum radius r_{04} of the incompressible cylinder 04, as well as a minimal thickness d_{11} of the layer 11 must be simultaneously taken into consideration. In an advantageous embodiment the thickness d_{11} has been selected in such a way that, in the unloaded state there is an excess dimension T_{03b} of approximately 0.13 up to 0.21 mm, in particular approximately 0.16 up to 0.18 mm in comparison with the loaded state, i.e. in case of contact the layer 11 is pushed in by the stated amount by the counter-pressure cylinder 04. If a previously unused rubber blanket 11 is employed, the transfer cylinder 03 initially has, as mentioned above, a radius r_{03u} in the unloaded state which is greater by a penetration thickness F (represented in dashed lines in Fig. 1), for example 0.02 to 0.05 mm, as well as a correspondingly increased excess dimension T_{03b} .

A contact position is preset, for example by means of one or several stops, in such a way that in their contact position the two cylinders 03, 04 have the above mentioned radius ratio in the area of the nip point 17 (connecting plane of the axes of rotation R03, R04), and wherein in an advantageous further development a ratio between the excess dimension, or penetration depth T03b, and the thickness d11 of the layer 11 lies between 5% and 15% in the unloaded (collapsed) state.

The mentioned conditions can be used in a first embodiment for cylinders 02, 03, 04 without bearing rings or, in another embodiment, also for cylinders 02, 03, 04 with bearing rings 21, 22, 23, as represented in Fig. 1.

In connection with the mentioned embodiments of the friction gears between the cylinders 02, 03, 04, in a second embodiment the bearing rings 21, 22, 23 can all have the same radius r_{21} , r_{22} , r_{23} . In this case the radius conditions between respectively two cylinders 02, 03, 04 and those of the associated bearing rings 21, 22, 23 differ from each other. For primarily making possible a roll-off behavior determined by the described friction gears of the cylinders 02, 03, 04, friction-reducing steps, for example increased lubrication, can be provided for the bearing rings 21, 22, 23. However, the bearing rings 21, 22, 23 can also be rotatably connected with the respective cylinders 02, 03, 04, so that a relative rotation of the bearing rings 21, 22, 23 and the assigned cylinder 02, 03, 04 is made possible.

In an advantageous third embodiment, the friction gears of the cylinders 02, 03, 04 as described above, as well as the friction gears of the bearing rings 21, 22, 23, as

described in what follows, have special radius ratios not equal to 1.

Thus, in an advantageous embodiment the bearing ring 21 of the forme cylinder 02 has a radius r_{21} , so that the ratio between the radius r_{02} of the forme cylinder 02 (surface 06) and that of the bearing ring r_{21} lies between 1.0007 and 1.0015, greater than 1.0009 and up to 1.0013, inclusive. For a cylinder 02 of double circumference, an overhang \ddot{U}_{02} of the surface 06 in respect to the bearing ring 21 lies between 0.10 and 0.23 mm, in particular between 0.15 and 0.19 mm. With a thickness d_{09} of the printing forme 09 of, for example, 0.25 to 0.33 mm, this must accordingly be taken into consideration in case of the dimensioning of the base body 08 with an undercut u_{02} in respect to the bearing ring 21. For example, the undercut u_{02} lies between 0.11 and 0.15 mm.

The bearing ring 23 of the counter-pressure cylinder 04 has a radius r_{23} , so that the ratio between the radius r_{04} of the counter-pressure cylinder 04 and that of the bearing ring r_{23} lies between 1.0004 to 1.0012, in particular between 0.0006 and maximally 1.0009. For a cylinder 04 of double circumference, an overhang \ddot{U}_{04} of the surface 06 in respect to the bearing ring 21 lies between 0.06 and 0.18 mm, in particular between 0.08 and 0.16 mm.

The bearing ring 22 of the transfer cylinder 03 has a radius r_{22} , so that the ratio between the (effective) radius r_{03b1} in the print-on position of the transfer cylinder 03 and that of the bearing ring r_{22} lies between 0.9978 and 0.9996, in particular between 0.9984 and 0.9990. For a cylinder 03 of double circumference, an overhang \ddot{U}_{22} of the bearing ring 22 in respect to the effective radius r_{031b} lies

between 0.13 and 0.22 mm, in particular between 0.15 and 0.20 mm. With a thickness d11 of the layer 11 in the loaded state of, for example, 1.03 to 2.30 mm, this must accordingly be taken into consideration in case of the dimensioning of the cylinder core 12 (base body 13 and possibly intermediate layer(s) 14) with an undercut u03 in respect to the bearing ring 22. For example, the undercut u03 lies between 1.6 and 2.6 mm.

For meeting the requirements made on the ratio of the radii r22 and r03b in the contact position in particular, the radii r21, r22, r23 of the bearing rings 21, 22, 23 have a special relationship with each other, which are explained in what follows:

For example, the bearing rings 21 and 23 of the forme and counter-pressure cylinders 02, 04 have the same radius r21, r23, therefore the ratio is 1.000. However, the ratio of the radii r21, r22 of the bearing ring 21 assigned to the forme cylinder 02 in respect to that of the transfer cylinder 03 lies in the range between 1.0010 and 1.0020, in particular in the range between 1.0010 and 1.0016. For cylinders 02, 03 of double circumference, the radius r21 is, for example, greater by 0.01 to 0.03 mm, in particular approximately 0.020 ± 0.005 mm, i.e. 0.015 to 0.025 mm, than that of the transfer cylinder 03. What has been said correspondingly also applies to the ratio between the radii r23 of the bearing ring 23 assigned to the counter-pressure cylinder 04 and that of the transfer cylinder. The mentioned conditions and sizes of the radii lead to differences in the diameter between 0.02 and 0.06 mm, and are therefore different in a pronounced way from the difference based on the presently customary manufacturing

tolerance of merely approximately 0.004 mm. It is therefore necessary to specifically attain the mentioned values, and they are not based on chance occurrences in the course of the manufacturing process.

In a fourth embodiment, each of the pairs of friction gears has a transmission ratio, or radius ratio of 1.000, in the contact position, wherein only the friction gears between two bearing rings 21, 22, 23 acting together in pairs have the above mentioned radius ratios, or transmission ratios which differ from 1.000.

The embodiments shown are of particular advantage in connection with printing units whose cylinders 02, 03, 04, or printing groups 01, are driven individually, in pairs or in groups. This is of particular advantage in view of undesired output displacements between the printing groups 01 in the case represented in Fig. 3, if several transfer cylinders 03 of several printing groups 01 act together with one mutual counter-pressure cylinder 04 designed as a satellite cylinder 04. Fig. 3 shows a printing unit 24 designed as a nine-cylinder printing unit 24, in which four pairs of forme and transfer cylinder 02, 03 are assigned to the satellite cylinder 04.

In an embodiment not represented, respectively two adjoining pairs 02, 03 are for example driven as a compound driven unit by a drive motor 26. The satellite cylinder 04 can be driven by one of the two compound driven units, but also by its own, third drive motor 26.

In the embodiment represented in Fig. 3, the cylinders 02, 03, 04 of the nine-cylinder printing group 24 are rotatorily driven by five drive motors 26. Each pair 02, 03,

and the counter-pressure cylinder 04 embodied as a satellite cylinder 04, has its own, at least rpm-regulated drive motor 26, which is mechanically independent of the other drive motors 26. The compound driven units formed by this have no mechanical coupling with each other, except for the previously described friction gears. In one variation the satellite cylinder 04 is simultaneously driven by two drive motors 26, wherein respectively one of these two drive motors 26, together with the drive motors 26 of respectively two pairs, is supplied by a common device connected to the electrical network. This permits a symmetrical layout of the supply of the rotatory drive mechanisms of the nine-cylinder printing unit 24 by means of two common devices connected to the electrical network.

The drive motors 26 are in a signal connection with a control and/or computing unit 27, for example, from which they receive desired value specifications regarding their number of revolutions. It includes a so-called "electronic shaft", i.e. elements for electronically synchronizing the drive motors 26. In a preferred embodiment, the drive motors 26, at least those of the pairs, are designed as drive motors 26 which can be regulated in regard to their angle of rotation position, and they receive specific values regarding their angle of rotation position through the control and/or computing unit 27.

In an embodiment represented in Fig. 4, each one of the cylinders 02, 03, 04 has its own drive motor 26, which is mechanically independent of the other cylinders 02, 03, 04. What has been said above should be analogously applied regarding the embodiment of the drive motors 26, the control

and/or computing unit 27, a possibly second drive motor 26 for the satellite cylinder 04, as well as the supply by means of two devices connected to the electrical network.

If, as represented in Fig. 5, the printing unit 24 is embodied as a ten-cylinder printing unit 26 with two satellite cylinders 04 assigned to the four pairs, the two satellite cylinders 04 can, as mentioned above, each be included in respective compound driven units, each of two pairs, can have one or two (common) individual drive motor 26, or can each be driven mechanically independently of each other by their own drive motors 26, as represented. Again the above mentioned drive in pairs (represented), or an individual drive of the cylinders 02, 03, 04 (as in Fig. 4) is provided for the pairs.

The cylinders 02, 03, 04, driven individually or in pairs, can for example be driven directly or indirectly, or example via a not represented gear, for example a toothed wheel, toothed belt or a friction gear.

In one embodiment at least the transfer and counter-pressure cylinders 03, 04 have a circumference, for example, between 850 and 1,300 mm, in particular 940 to 1,200 mm. The forme cylinder 02, too, here has this circumference (for receiving, for example, four vertical printed pages arranged side-by-side, in particular newspaper pages). The length of the usable barrel of the cylinders 02, 03, 04 is, for example, 1,100 to 1,800 mm, in particular 1,400 to 1,700 mm.

The above embodiments can also be applied in connection with cylinders 02, 03, 04 of single circumference or, for example, in connection with a forme and/or transfer cylinder 02, 03 of single, and a counter-pressure cylinder of double

circumference. The width of the cylinders 02, 03, 04 can be single, double, triple or quadruple.

In view of drive outputs, which are high anyway, the described embodiments are also advantageous in connection with particularly wide, for example 1,850 to 2,400, and thick, for example double circumference, cylinders 02, 03, 04. The circumference is embodied for receiving two vertical printed pages, for example newspaper pages in broadsheet format, by means of two dressings, for example flexible printing formes, which can be fixed in place on the forme cylinder 02 one behind the other in the circumferential direction. In the axial direction, the forme cylinder 02 is sized to receive, for example, at least six vertical printed pages arranged side-by-side, in particular newspaper pages in broadsheet format. In this case it is a function inter alia of the product to be produced whether respectively only one printed page, or several printed pages are arranged side-by-side on a printing forme. The transfer cylinder 03 is occupied in the linear direction with, for example, three dressings 11 side-by-side, for example rubber blankets 11. In the circumferential direction they substantially extend around the entire circumference. For example, the rubber blankets 11 are arranged alternately offset in respect to each other, for example by 180°, and have a favorable effect on the oscillation behavior of the printing group 01 during operation.

A ratio of a length of the usable barrel of the cylinders 02, 03, 04 to their diameter preferably is 5.8 to 8.8, for example 6.3 to 8.0, in a wide embodiment (six printed pages wide) in particular at 6.5 to 8.0.

In this case the length of the usable barrel is to be understood to be that width or length of the barrel, which is suitable for receiving dressings. This also approximately corresponds to a maximally possible web width of a web to be imprinted. In this case possibly existing bearing rings, operating areas or rivets in the area of the shell face close to front are not considered.

List of Reference Symbols

01	Printing group
02	Cylinder, forme cylinder
03	Cylinder, transfer cylinder
04	Cylinder, counter-pressure cylinder
05	-
06	Surface
07	-
08	Base body
09	Printing forme
10	-
11	Layer, dressing, rubber blanket
12	Cylinder core
13	Base body
14	Intermediate layer, underlayer
15	-
16	Nip point
17	Nip point, print location
18	Web, paper web
19	-
20	-
21	Bearing ring
22	Bearing ring
23	Bearing ring, 9-cylinder satellite printing unit
24	Printing unit, nine-cylinder printing unit
25	-
26	Drive motor

27	Control and/or computing unit
28	Ten-cylinder printing unit
d09	Thickness (09)
d11	Thickness (11)
d11b	Thickness (11), loaded
F	Penetration thickness
r02	Radius (02)
r03b	Radius (03), loaded
r03b1	Radius (03), loaded
r03b2	Radius (03), loaded
r03u	Radius (03), unloaded
r04	Radius (04)
r08	Radius (02)
r12	Radius (12)
r13	Radius (13)
r21	Radius (21)
r22	Radius (22)
r23	Radius (23)
R02	Axis of rotation (02)
R03	Axis of rotation (03)
R04	Axis of rotation (04)
T03a	Excess dimension (11)
T03b	Excess dimension (11)
Ü02	Overhang (02, 21)

Ü04 Overhang (04 , 23)

Ü22 Overhang (22, 03)

u02 Undercut (02)

u03 Undercut (03)